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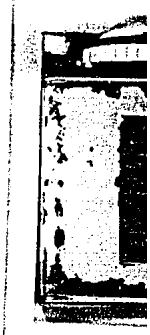

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MATERIALS CONSERVATION BY USSR SCIENTIFIC RESEARCH ORGANIZATIONS

/Comment: The following is taken from an article by A. Vovk, Chairman of the Council of Experts, Gossnab (Main Administration of State Supply) USSR. In this article, the author not only contributes information on existing conditions but appears to be free to criticize the activity of various organizations. Moreover, because of his official position, he has certain authority to direct this activity.

Therefore, despite its sketchiness, the information presented is of considerable interest as regards Soviet trends and efforts in the field of materials conservation./

The rational utilization of material resources is one of the essential tasks of scientific research activity in the USSR. Scientific research institutes of the Academy of Sciences USSR and the ministries, and also design bureaus and laboratories of industrial establishments and building organizations have successfully developed a number of substantial projects in the economy and application of sound substitutes for expensive materials.

For instance, a process was developed at the design-technological bureau of an agricultural machine building plant for obtaining sheet metal directly out of liquid cast iron. This work, supervised by Engineer Ye. F. Nikolayenko, gave rise to the possibility of replacing sheet steel with cast-iron sheet in construction works and in machine building.

One of the Moscow plants adopted a new technology for manufacturing machine parts in a forge shop. This technology was developed according to suggestions and designs of the Giproavtotraktoroprom (State Planning Institute for Machine-Building Plants of the Automobile and Tractor Industry) and of the

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scientific research institute supervised by Prof V. P. Vologdin. In the new process, steam hammers were replaced with mechanized forging presses, and through heating of ingots is carried out in high-frequency induction furnaces with automatic temperature control. The new practice increased th productive capacity of equipment and reduced by 14% the amount of rolled stock required per set of forgings for a passenger car.

The All-Union Scientific Research Institute of Agricultural Machine Building (VISKhOM) conducted a number of works on the conservation of steel rolled stock in agricultural machine building. In particular, the institute worked out a method for repairing and reconditioning plow shares by welding. The method was used in 1951 for repairing over 200,000 shares, saving more than 1,000 tons of steel. Wide application of this method would result in conservation of 20,000-25,000 tons of steel annually.

The same institute established new standard designs for bearing bushings of agricultural machines. The application of these bushings in production on a large scale will save an amount of bronze equal to over 20 tons per 1,000 sets of bushings.

Effective works on the conservation of nonferrous metals have been conducted at the Scientific Research Automobile and Automotive Institute of the Ministry of the Automobile and Tractor Industry (NAMI). For example, a cast aluminum alloy manufactured out of inexpensive and abundant secondary alloys was developed at NAMI, and its use at the Gor'kiy Automobile Plant for the heads of GAZ-51 cylinder block has been releasing hundreds of tons of primary aluminum annually, and at the same time has been simplifying the fabrication of heads and reducing the consumption of electric power by over 300,000 kw-h per year.

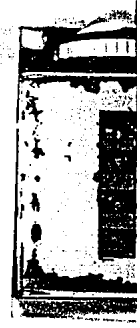
Automobile plants manufactured and tested experimental radiators with steel plates, galvanized or zinc-coated by hot dipping, soldered to brass tubes with zinc. This practice saves 5-6 kg of brass and nearly one kg of tin solder per car.

A number of works on metals conservation were conducted by the Central Scientific Research Institute of the Ministry of Heavy Machine Building (TsNIITMASh). Earlier turbine blades were made entirely of stainless steel. In the process of constructing the blades for turbines of the Tsimlyanskaya power station, the institute has developed a method for facing blades made of carbon steel with plates of stainless steel.

TsNIITMASh also completed testing of a new grade of economical steel, which replaces various steels in making cutting tools, and investigated the optimum conditions of metal cutting and the rational geometry of cutters with mineral-ceramic tips, which may substitute for tips made of hard alloys.

A number of scientific works aimed at the conservation of metal, timber, and structural materials were carried out at scientific research construction organizations.

Thus, the Scientific Research Institute of the Ministry for Construction of Machine-Building Enterprises developed a number of new economical profiles for reinforcing rods and new designs for beams and trusses. The application in construction works of a new type of cold-flattened reinforcing rods of periodic profile provided for a saving of steel of up to 20%. The introduction into construction works of prestressed beams permitted a considerable decrease in the weight of metal constructions. If steel consumption in an ordinary 18-meter truss amounts to 18-20 kg per sq m, it does not exceed 6-7 kg per sq m in the case of using prestressed beams.



The same institute worked out a new design for a rod truss with crossed braces, considerably reducing the weight of a truss, and also new prefabricated large-panel constructions of roofing and walls.

Of great significance are scientific research works in the field of fuel conservation. A number of institutes found successful solutions for many essential problems. Some of these solutions are as follows: designs of automobiles with steam plants, operating on wood, peat and coal; improvement in design of gas-generator automobiles operating on raw wood and local fuels; designs of highly efficient diesel engines for automobiles and tractors; conversion of diesel engines from liquid to gas fuel; development of automobile gas containers, etc.

A considerable conservation of petroleum products has been achieved by the Central Scientific Research Institute of Railroad Transport (TsNIIZhD) in its works on conversion of oil engine locomotives and electric power stations to generator gas.

The All-Union Heat Engineering Institute (VTI) has developed a new method for feed-water deaeration without preheating. Application of this method at two Moscow plants reduced metal consumption to half of that for a thermal-type deaerator, improved protection of the equipment against corrosion, and decreased fuel consumption by 2%. In testing high-pressure turbines of a hydroelectric power station, the institute found it possible to utilize the heat of exhaust steam for preheating boiler feed water. This measure alone has been saving up to 2,000 tons of fuel per year.

A number of scientific research works also have been carried out in the field of nonferrous metals conservation and substitutes for these metals, conservation of timber materials, certain chemicals, electric power, etc. Numerous works on the conservation of material resources were recognized as outstanding, and their authors were awarded Stalin prizes.

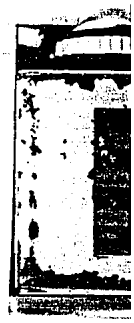
In spite of certain achievements of Soviet scientific thought in the field of materials conservation, it should be concluded that scientific research institutes, design bureaus, and laboratories could and, consequently, should achieve still more in the struggle for the rational and economical utilization of raw materials, fuels, and electric power.

The problems of materials conservation are still occupying an insignificant place in the thematic plans of institutes and other scientific research organizations.

For instance, only a single theme directly related to conservation problems was included in 1951 in the activity program of the Scientific Research Institute of Construction and Road Machine Building, which is the only institute of the Ministry /of Construction and Road Machine Building/. In a working plan of the VISKhOM, one of the largest machine-building institutes, only 11 out of 140 themes dealt with the problems of materials conservation. Also, there are few themes on this subject in the working plans of such institutes as TsNIITMASh, TsNIIZhD, NAMI and others.

In particular, scientific research institutes pay little attention to such problems as rationalization of cutting metals out of ingots, conversion of rolling machine parts to casting, utilization of low-alloy steels, increase in yield of sound products in forge and stamping shops, and utilization of substitutes and new materials.

The problems of regulating the consumption of materials and development of new progressive norms are worked out on a very small scale in scientific research institutes. Profound study and generalization of the advanced experience of industrial innovators in the field of materials conservation does not occupy the proper place in the activity of scientific research institutes.



The underestimation of the problems of rational utilization of materials must be urgently eliminated from the practice of scientific research organizations, and their attitude toward these problems must be radically changed.

However, the activity of various organizations should not cease after the solution of a certain scientific technical problem is found. Scientific research works should be considered completed only when they are introduced into production and give practical results. Meanwhile, there are many cases of slow and incomplete promotion, into industrial practice, of the works completed by scientific research organizations.

Thus, for example, a number of the institutes of machine-building ministries have lately developed a procedure for casting steel, cast-iron and nonferrous parts by the investment casting process. Castings obtained by this method need almost no machining, possess high properties, and require less metal than ordinary castings or forgings. Precision casting is especially effective in fabricating intricately shaped articles requiring a considerable amount of machining which involves enormous loss of metal in chips.

The application of the investment casting method for fabrication of 11 parts at the Noginsk Plant of Fuel Equipment has decreased the amount of metal required by 47% as compared with forgings and reduced processing time in 63 operations. This released 59 machine tools and 118 operators with a corresponding reduction in operating area; simultaneously the net cost of products was reduced by 8.3%.

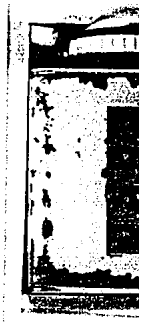
Despite these advantages, however, the industrial implantation of the investment casting method has been realized very slowly; and at present, the new method is used on an absolutely inadequate scale even at such mass-production plants as the Moscow Automobile Plant imeni Stalin, the Gor'kiy Automobile Plant imeni Molotov, and the First Bearings Plant imeni Kaganovich.

The Scientific Research Automobile and Automotive Institute completed its work on increasing the strength of automobile springs by preloading them to the yield point. This so-called method of plastic deformation increases the life of springs several times and saves a noticeable amount of metal. The laboratory and field tests of strengthened front springs of the ZIS-150 automobile showed that 16-leaf springs of this automobile may be successfully replaced by 12-leaf springs. These works, although completed in 1950, have not yet received due practical application.

Certain machine-building ministries and enterprises are delaying industrial tests and utilization of new, more economical grades of steel. The introduction of oxygen blowing into blast-furnace and open-hearth practice is developing slowly. Numerous construction organizations are extremely cautious in using new structural materials.

The industrial application of the furnace with rabbling strip, designed at the All-Union Heat Engineering Institute, shows little progress, although this furnace provides for a 5-% saving in fuel with a simultaneous decrease in the number of personnel. The drying installation, developed by the same institute in 1950 for drying coals with high moisture content, has not been used in industry in spite of the fact that the application of this device increases the productive capacity of boiler installations and reduces fuel consumption.

All the examples here mentioned indicate that certain workers of ministries and industrial establishments do not display the proper interest and persistence in the promotion of completed scientific research works. This factor can be considered only as a manifestation of technical conservatism and stagnation. Improvement in the field of materials conservation is urgent.



General problems in the field of the rational utilization of material resources in the Soviet national economy may be presented as follows:

1. Perfection of the designs of structures and products for reducing the consumption of materials required for their fabrication.

2. Improvements in the production technology and increase in the application of high-productive equipment to attain the maximum coefficient of materials utilization.

3. Raising the efficiency factor of power and transport installations and the wider application of local fuels for better utilization and maximum decrease in the consumption of petroleum products, high-quality coals, and electric power.

4. Rational organization of production and its supply system in order to reduce excessive supply stock and decrease losses of materials, fuels, and electric power.

These general problems determine a great number of individual subjects in the field of conservation of metals, fuels, electric power, and structural materials, which must be included in the thematic plans of scientific research works for 1953.

To these subjects belong, first of all, the projects connected with expedient decrease in the weight of structures, machines, and metalware. Particular attention must be paid to maximum decrease in the consumption of nonferrous and high-alloy metals, and to replacing rolled stock with castings and metals with nonmetallic materials. Obviously, all these changes must be combined with systematic improvement in the operating properties of structures, machines, and parts and with prolongation of their service life.

Design and calculation methods must be improved on the basis of progress attained by the workers of science and production in studying the properties of materials and their behavior under various operating conditions. On the basis of results obtained, safety factors, which are frequently increased without substantiation, must be reduced, decreasing the calculated dimensions of an object under design or permitting replacement of expensive materials with those less expensive.

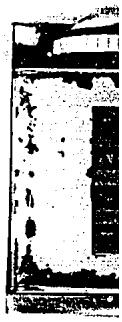
The works indicated should be carried out taking into consideration all the methods now widely used for strengthening metal articles, such as shot peening, surface rolling, prestressing, surface or selective induction heat treatment, etc.

At the same time, scientific research works must be conducted in the field of developing new structural materials, for example, low-alloy steels, ceramic and chemical substitutes for metals, products obtained by wood processing, and others.

An essential part in metals conservation belongs to rolling methods for obtaining rolled stock of so-called improved profile, such as periodical or hollow profiles, or profiles with negative allowances.

The Council of Experts of Gossnab USSR has estimated that it is possible to save, even during the next 2-3 years, hundreds of thousands of tons of ferrous rolled products by improving the design and decreasing the weight of machines. Tens of thousands of tons of metal may be saved annually in capital construction works by using rolled stock of improved profiles.

The next essential group of subjects, which must occupy an important place in the plans of scientific research and experimental design works for 1953 and the following years, deals with improvements in the utilization of materials



used in production. In particular, this refers to metals, and especially to nonferrous rolled products, since their utilization in production is still on a low level. In the machine-building industry, for instance, the coefficient of rolled stock utilization amounts on an average to 0.75-0.80; this means that 20-25% of the rolled metal consumed by this industry is lost in the form of wastes and chips.

According to the data for 1949-1951, a particularly low coefficient of rolled stock utilization was maintained at the establishments of the following ministries: Construction and Road Machine Building, Automobile and Tractor Industry, Machine and Instrument Building, and Machine Tool Building. In individual productions, this coefficient happened to be still lower. For example, in the fabrication of roller bits at plants of the Ministry of the Petroleum Industry, only 20-40% of hot-rolled metal was utilized; in the production of couplings for drilling pipes, 41-45%. At the plants of the Ministry of the Coal Industry, only 40-50% of the rolled stock consumed was actually utilized in the manufacture of coal-cutting machines.

The basic and most effective measures for increasing the coefficient of metal utilization are as follows:

1. Improvements in the layout of metal with utilization of cuttings.

2. Conversion from open forging to die forging and use of forging presses instead of hammers; this practice reduces the weight of blanks and decreases allowances for machining.

3. Application of improved casting methods in foundry practice, such as precision and die casting, which permit obtaining castings with minimum allowances for machining.

All these measures, as was established by the direct study of technological processes in 1950 and 1951, may result in saving hundreds of thousands of tons of metal per year. This amount can and should be increased on the basis of scientific works.

Great problems must be solved in the field of rational consumption and conservation of fuels and electric power. There are still considerable possibilities for improvement in their utilization.

Further wide expansion of district heating systems is of great significance for fuel conservation. However, in this field, there is still a number of large technical and economical problems which require scientific technical solution.

Increase in the efficiency of electric power stations may be promoted by using steam of high parameters. However, the application of such steam is connected with a number of exploitation difficulties, such as breakdowns of preheaters, economizers, and steam superheaters; adaptation complexity of high-pressure feeding pumps; steam losses due to the imperfection of high-pressure fittings, etc. Analysis of these difficulties and development of ways and methods for their elimination are the urgent tasks of the responsible research and design organizations.

An increase in the effectiveness of utilization of local low-grade fuels involves considerable improvements in furnace processes and firing technique. It is necessary to simplify and make less expensive the preparation of fuel for combustion. A number of steam-electric power plants have been using simple and compact driers and air- or steam-type coal mills, requiring considerably less metal for their manufacture than ordinarily used. This experience must be studied, generalized, and widely introduced into practice.

Scientific research organizations should also study more deeply and generalize scientific and practical experience in the field of decreasing heat losses with exhaust gases by design improvements of air preheaters, economizers, etc.

Serious scientific research problems must be solved in the field of further mechanization and automatization of difficult and labor-consuming works in large boiler plants of electric power stations. Particular attention must be paid to the problems of complex mechanization and automatization.

It is also necessary to develop, more widely than heretofore, methods for the utilization of fuels as raw materials in the technological processes for obtaining high-quality fuel simultaneously with valuable chemical products (power-chemical utilization of fuels and processing of low-grade solid fuel into a high-quality synthetic liquid fuel).

Large and diverse problems are posed before the scientific research institutes active in the field of studying structural materials and construction practice. Thus, intensive work must be carried out on improvements in the production technology of cements in order to provide for the stability of their quality. The development of methods for testing cement in the process of its manufacture is of scientific and practical interest.

The activity plans of such scientific research organizations as Orgtransmash (State Trust for the Organization of Production in Transport-Machine Building), Orgavtoprom (State Trust for the Organization of Production in the Automobile Industry), and the Institute of Economics of the Academy of Sciences USSR must include works on the scientific development of methods for the calculation of required production supply stock.

Despite the great economical significance of such calculations, the overwhelming majority of scientific organizations have not heretofore paid any attention to this problem.

The considerations presented here are by no means an exhaustive study of the subject. They outline only certain trends in the field of rational utilization and conservation of material resources and emphasize the urgency of including corresponding works in the activity programs of scientific research organizations for 1953.

Many problems cannot be solved by a single institute or laboratory and require the unified efforts of several scientific research organizations. In particular, it is important that the numerous works of industrial scientific research institutes and laboratories be supported by participation of the institutes incorporated in the Academy of Sciences USSR and in the Academies of Sciences of the Union Republics.